REPORT

ON

PROPOSED SHIPYARD AT BHATKAL.

Accompaniment to file no. 8672/36. El. Br

(P 32/E)

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NOVEMBER. 1946

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REPORT ON PROPOSED SHIPYARD AT BHATKAL.

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PROPOSED SHIPYARD AT BHATKAL.

1. Scope

This report deals with the proposal to construct and equip a shipyard at Bhatkal; the proposals are of a preliminary nature as the site has not yet been subjected to a detailed survey, and the scheme has not been examined in detail except in so far as is necessary to ensure that the proposals are practicable.

We understand from Mr. A.M.Bhat that Government regulations do not permit a site survey to be made unless a Company has been registered.

2. Site.

The site chosen for the shipyard is a stretch of coast about 1¼ miles in length on the west coast of India, at the extreme south of the Bombay Presidency. Its southern boundary rests on Lat. 14° north and is about 4 miles north of Bhatkal. Bhatkal is 365 miles south of Bombay, within 16 miles of the borders of Mysore State and 54 miles from Talguppa, the point at which the metre gauge line of the Mysore State Railway terminates. A general plan of the area is given on Drawing No.6773.

3. Natural conditions

The only references we have to the site are given on Admiralty Chart No.744 dated 1899 and corrected to 1943 which covers the sea approaches, and to Government of India Survey Sheet Nos.48.J/8 & 12 scale 1" to the mile, which covers the land side. The

/rainfall...

rainfall is known to be about 140 inches a year and that from June to October south west monsoon conditions prevail. In addition a number of panorama photographs of the site were available. Other information on the sea approaches has been given by Mr. A.M.Bhat regarding the depth of water in the area of the proposed shipyard. This was given as 20 feet at a distance of 800 feet and 30 feet at 1500 feet from the shore. These observations are not supported by the Admiralty Chart, and pending a more detailed survey of the area the Admiralty Chart has been accepted as a basis for estimating.

In regard to the land side it appears from the photographs that the ground for some distance inland is flat and does not rise more than a few feet above high tide level.

The nature of the sea bed is given as sand overlying rock and of the land a similar formation.

4. Requirements

The shipyard is to be suitable for the simultaneous construction of:

(a) 50 timber craft of up to 100 tons displacement and 100 ft in length.

(b) 10 composite craft of up to 400 tons displacement and 140 ft. in length.

(c) 5 steel ships of up to 1,500 tons displacement and 240 ft in length.

The shipyard and workshops are to be complete and self contained except that engines and auxiliaries, boilers, stern frames and other heavy manufactured items will be imported.

Suitable fitting out berths are required, and in addition 1,000 ft of deep water berthing with a low water depth of 20 feet is to be provided.

5. Drawings accompanying this report:

Drg. No. 6773.	West coast of India.
Drg. No. 6774.	Site and general layout plan.
Drg. No. 6775.	General arrangement of workshops and building slips.

6. Site for yard

From the data available it appears that there are only two possible sites suitable for the proposed yard, one at the south, and the other at the extreme north end of the area. In view of the many obstructions surrounding the first site, that at the northern end has been selected as the most suitable. It has already been stated that there is not sufficient information available to say with any certainty that the selected site is the most suitable. Before this can be done it will be necessary to carry out current and littoral drift surveys under fair weather and monsoon conditions, and to make a detailed survey of the bed both as regards water depths and the nature of the sea bed. The formation of the coast to the north of the Venkatapur River and the bar which has formed at its mouth, indicates sand travel. This may not be a serious matter, but its magnitude must be ascertained. Wind data will also be required.

The location shown in the site plan on Drg. No.6774 appears to be the most suitable. The mean launching depth of the larger craft has been assumed at 8'0", and it is necessary, therefore, to build the launching ways on made ground off shore in order to obtain sufficient depth of water for launching.

The suitability of this choice of site can only be confirmed by detailed surveys of the foreshore, tides, currents, silt and sand deposits, wind, etc.

7. Location of fitting out and deep water berths

The question of natural anchorages with weather protection is one that will require full investigation; the results will affect the disposition and the type of construction of the deep water wharf.

The location shown is the most convenient for access to and from the shipyard.

/8. ...

8. Shipyard construction

In view of the shallow water offshore and the gradually shelving beach it is essential to keep the declivity of the launching ways as small as possible, thus avoiding the expense of additional reclamation offshore or of dredging to obtain sufficient depth. A slope of 1 in 30 is therefore recommended in conjunction with roller carriage cradles and a 'down haul' for launching. If the declivity is 1 in 30 it is estimated that a maximum depth of 12'0" will be sufficient for launching.

Drg. No.6775, following the general layout visualised by Mr. A.M.Bhat, shows the disposition of the building ways to accommodate the required number of craft. The composite and country craft would be built with 2 or 3 craft on a slip, and would be launched from the lowest position on the slip; the craft under construction higher up the slip would then be hauled down into the lower position for completion, allowing new craft to be commenced at the top end of the slip.

The building berths are all 300 ft in length above high water level, and a 100 ft wide transverse bay at the head of the slips allows for assembly and prefabrication of finished plates.

9. Workshops layout and buildings

The general layout and shop areas proposed by Mr.Cruickshank appear to be adequate, and allow for some future expansion.

All the shops, prefabricating bay, and building berths are covered by north light roofing, and it is suggested that the glazing might be omitted over the building berths for economy and for improved ventilation.

The general disposition of the yard and the stores appears adequate; a shipchandlers store and a sailmakers and rigging loft have been added, and it is also proposed that the sawmill

/should...

should be separated from the main workshops block, and that the power station should be situated outside the boundary wall.

The workshop floor level has been fixed at 4'0" above high water level in order to lessen the amount of fill required; this involves a small reverse slope from the head of the building berths, but there appears to be no objection to this feature.

All shop floors and storage areas are assumed covered by a concrete slab.

10. Shipyard Cranes (see Appendix A for list of cranes)

A 10 ton overhead electric crane has been allowed for over each of the ship building berths, and 30 cwt swinging jib cranes on the stanchions.

For the composite and country craft building berths a roller carriage has been shown running on the bottom flange of each roof girder; chain hoist blocks up to 1 ton lift can be attached to this carriage as required.

A 10 ton semi-goliath crane serves the assembly and prefabricating bay, and 5 and 10 ton overhead cranes have been provided for the workshops. In addition a number of mobile cranes have been included for general yard use.

11. Shipyard Plant and Machinery

(see Appendix B - Workshops Machinery and Plant
Appendix C - Misc. Plant and Equipment).

The machinery and plant specified by Mr.Cruickshank has been included with only minor additions, and appear to cover adequately all requirements.

12. Power Station

The maximum demand of the shipyard and jetty has been estimated at 1,700 K.V.A after making corrections for diversity and power factor; the installation of 3 - 750 K.V.A and 2 - 350 K.V.A.

/diesel...

diesel sets is recommended in order to cover the Town load (estimated at 400 K.V.A.) and to provide adequate standby power.

13. Fitting out and deep water berth

The arrangement suggested on Drg. No.6774 shows a 800' x 92 ft wharf with 20 ft depth of water alongside, and an approach jetty whose length will depend on the distance off shore at which deep water is found. If the Admiralty chart is correct the approach jetty will be 4,000 ft long; if Mr. Bhat's soundings are correct the length will be not greater than 1,500 ft. For estimating purposes the longer length has been assumed, but alternative figures have been included in the estimate to show the approximate reduction in cost which is made by the substitution of the shorter jetty. The fitting out berth is provided by widening the 34 ft approach jetty to 53 ft for 1,000 ft of its length.

It is suggested that the west side of the deepwater wharf should be used for passenger working and cargo discharge, and the east side for heavy fitting out and lay-by purposes, but the major part of the fitting out would be completed on the approach jetty berths.

From the information available a piled structure does not appear to be practicable, and it has been assumed that the structure would be carried on reinforced concrete piers founded on rock; the type of structure, however, will depend on the results of local investigation. The deck will be of reinforced concrete, designed to carry metre gauge shunting locomotives or 3 ton mobile cranes. Adequate rail facilities from shipyard to deep water wharf are to be provided, and a 22 ft wide roadway.

The cranes and equipment provided (see Appendix A) include a 60 ton fixed crane for lifting boilers, engines, etc., 3 - 10 ton portal cranes for other fitting out work, and 4 - 3 ton crank luffing portal cranes for ships' cargo working. It is not intended

/to...

to provide any heavy lifting facilities in the shipyard, and it will therefore be necessary for heavy lifts which enter the port by sea to be stored either in lighters or on the deck of the deep water wharf until such time as they can be fitted. All the lighter lifts, winches, auxiliaries, etc., can be handled either by a light hoist on the 60 ton crane, or by the 10 ton portal cranes, or by the 3 ton mobile cranes.

The provision of power operated capstans, and of 4 metre gauge diesel shunting locos has also been allowed for.

14. Cost

The plant and machinery have been estimated in sterling f.o.b. and 25 per cent added for freight, customs and erection.

Construction cost (see Appendix D) has been estimated on unit costs obtained from similar work executed in India, but these figures can only be approximate on account of the absence of foundation and other physical data.

The total cost (see Appendix E) will be in the order of Rs/- 2,75,00,000 (or approximately £2,000,000), of which Rs/- 130,000 represents the cost of site survey and exploration.

The total cost would be reduced to approximately Rs/- 2,37,00,000 if a shorter jetty is found to be adequate.

Appendix F is a statement of the staff required for the working of the shipyard and their proposed rates of pay; comment on the proposed rates of pay is outside the scope of this report, but the numbers appear to be adequate.

15. Conclusion

The proposals have been examined in as much detail as is possible at the present stage of the project; the shipyard layout and equipment embodies the best modern practice, and is complete in itself.

/It...

It is considered essential that a repair slip should be constructed as an adjunct to the main shipyard facilities, but provision has not been made in the estimate for this additional item.

It is of course impossible to give a final opinion on the proposals, or on the extent to which modifications will be found necessary on investigation of site conditions.

The customary procedure of surveying the site before compiling the report would also have been preferable in this case, and it is regretted that it was not possible.

In general, however, it is considered that the proposals are practicable and that the scheme is a sound one from an engineering point of view.

SIR BRUCE WHITE, WOLFE BARRY & PARTNERS

1st November, 1946.

Appendix "A"

BELTKAL SHIPYARD - CRANES

	Location	Description	No.	H.P. (Largest Motor)	H.P. (Total)	Approx. cost F.O.B.
1	Building Berths	10 ton Overhead	5	20	100	£17,500
2	Hull Shop & Welding Shop	10 ton Overhead	3	20	60	£ 9,000
3	Foundry & Machine Shop	5 ton Overhead	2	12	24	£ 5,000
4	Prefabricating & Assembly Bay	10 ton Semi-Goliath	1	20	20	£ 6,000
5	General Yard & Shop use	"Centurn" Mobile 5 ton	4	-	-	£10,400
6	" "	"Jones" Mobile 2 ton	2	-	-	£ 3,000
7	Fitting Out Berths	60 ton Fixed Crane	1	70	70	£ 7,000
8	" "	10 ton Portal	3	40	120	£30,000
9	" "	3 ton Portal	4	35	140	£32,000
10	" "	Ransome Mobile 3 ton	2	-	-	£ 4,000
				Total H.P.	534	
				Total Cost		£125,900

Appendix "B"

BHATKAL SHIPYARD

WORKSHOPS, MACHINERY AND PLANT.

Item No.	No.	Description.	Approx. Cost F.O.B.	H.P.	Remarks.
		DRAWING OFFICE			
1.	1	Maiden machine for taking blue prints.	£250.		
2.	1	Planimeter.	£ 15.		
3.	1	Intergraph.	£115.		
		PNEUMATIC PLANT			
4.	1	Vertical 2100 cubic capacity installation, with all receivers, tanks, valves, piping, etc.	£4600.	435	
5.	3	Portable plant - 6 diesel machines each of 210 cubic feet capacity.	£8000.		
		HYDRAULIC PLANT			
6.	2	Hydraulic Pumps with receivers, rams, etc.	£6000.	150	
		In lieu of above, independent pumps may be fitted to each machine, at approx. same cost and H.P. requirements.			
		HULL SHOP			
		Hydraulic machine (see list Hull Shop).			
		Joggling machine (see list).			
		Keel plate flanging machine (see list).			
		Frame levelling machine (see list).			
		Frame bending rams (see list).			
		Portable riveters (see list).			
		WELDING PLANT FOR SHIPYARD - Stationary plant			
		Prefab and Welding Shop			
7.	4	Multiple operator sets suitable for 12 operators at 300 amps or 6 operators at 600 amps.	£3500.		
		Berths			
8.	4	-Ditto-	£3500.		
		Carried forward	£25,980.	585	

Item No.	No.	Description.	Approx. Cost F.O.S.	H.P.	Remarks.
		Brought forward	£25,980.	585	
		Hull Shop			
9.	2.	Single operator - 300/400 amps.	£ 800.		
		Blacksmith Shop			
10.	1	-Ditto-	£ 400.		
		Plumber Shop			
11.	1	-Ditto-	£ 400.		
		S.I. Workshop			
12.	1	Single operator - 300/400 amps.	£ 400.		
13.	1	Spot Welder - for sheet iron work.	£ 400.		
		Engine Shop			
14.	2	Single operator - 300/400 amps.	£ 800.		
		Foundry Shop			
15.	1	-Ditto-	£ 400.		
		Portable Plant			
16.	2	Diesel driven (2 operator each) welding machines.	£ 3,000.		
		SUNDRIES			
17.	30	Pneumatic Hammers - riveters, large.	£ 1,500.		
18.	30	Pneumatic Hammers - riveters, small, with all hose etc.	£ 1,200.		
19.	50	Riveters heating fires (portable) with blowers (hand)	£ 1,600.		
		BURNING PLANT			
20.	20	Sets with oil nozzles, hose, pressure gauges, etc.	£ 2,000.		
		RIVETER HYDRAULIC PLANT			
21.	1	Portable hydraulic riveter, 72" gap.	£ 1,200.		
22.	1	Portable hydraulic riveter, 30" gap.	£ 800.		
		Carried forward	£40,880.	585	

Item No.	No.	Description.	Approx. Cost F.O.R.	H.P.	Remarks.
		Brought forward	£40,680.	585	
		MACHINERY SHOP - All machines independently motored.			
23.	1	30 ft. Lathe between chucks.	£ 5,500.	30	
24.	1	16 ft. Lathe between chucks.	£ 5,000.	30	
25.	6	8 ft. Lathes between chucks.	£13,000.	60	
26.	6	Slotters.	£11,000.	100	
27.	6	Shapers.	£ 3,800.	50	
28.	2	Planing machines, horizontal tables, 16' x 7'.	£14,000.	120	
29.	6	Drilling machines, vertical up to 2".	£ 4,000.	30	
30.	1	Horizontal Drilling machine up to 2".	£ 1,200.	5	
31.	3	Milling machines (assorted).	£ 5,000.	30	
32.	6	Grinders (assorted).	£12,000.	100	
33.	6	Buffs (assorted).	£ 800.	30	
34.	4	Plane Tables each 6' x 6' planed surface.	£ 300.		
35.	1	Overhead crane, 5 tons (see list of Cranes).			
36.	1	Horizontal Borer.	£ 2,500.	25	
		FOUNDRY - All to be of the latest practice.			
37.	1	3-4 ton cupola with all charging gear and blower.	£ 2,400.		£1,000 allowed for charging gear.
38.	1	40-50 cwt. geared ladle.	£ 200.		
39.	1	20-30 cwt. geared ladle.	£ 150.		
40.	4	Double hand ladles.	£ 130.		
41.	4	Single hand ladles.	£ 80.		
42.	1	Core oven.	£ 5,000.	5	
43.	1	Portable pneumatic core booster.	£ 400.		
44.	1	Crucible tilting furnace for brass.	£ 1,500.	5	
		Carried forward	£124,840.	1205	

Item No.	No.	Description.	Approx. Cost F.O.B.	H.P.	Remarks.
		Brought forward	£124,640.	1205	
45.	10	Pairs moulding boxes.	£ 100.		
46.	4	Treble.	£ 80.		
47.	6	Plumber hearths and blowers.	£ 350.		
48.	1	Overhead crane, 5 tons (see list of Cranes).			
49.	20	Small crucibles.	£ 450.		
50.	20	Cast iron 6' x 4" blocks for marking off purposes.	£ 1,200.		
		PLUMBERS SHOP			
51.	1	Pipe bending machine, up to 3" diam.	£ 150.		
52.	1	Pipe bending machine, up to 3" diam.	£ 100.		
53.	1	Pipe flange welder.	£ 400.		
54.	1	Ram for pipe bending.	£ 400.		
55.	6	Coppersmiths hearths with blowers.	£ 350.	5	
56.	6	Plumber hearths with blowers.	£ 300.		
57.	20	C.I. blocks for pipe bending purposes.	£ 1,000.		
		All Machines to be supplied with holding down bolts.			
		SHEET IRON SHOP - All hand operated.			
58.	1	Folding machine.	£ 90.		
59.	1	Wheeling and raising machine.	£ 80.		
60.	1	Swaging, wiring and closing machine.	£ 150.		
61.	1	Circle cutting machine.	£ 100.		
62.	1	Small punching machine.	£ 50.		
63.	1	Throatless rotary shears.	£ 100.		
64.	1	Angle iron bending rolls.	£ 120.		
65.	1	Heavy rolls for plates.	£ 80.		
		Carried forward	£130,690.	1210	

Item No.	No.	Description.	Approx. cost F.O.B.	H.P.	Remarks.
		Brought forward	£130,690.	1210	
66.	1	Combination guillotine.	£ 90.		
67.	1	Grooving machine.	£ 110.		
68.	1	Sheet metal slip roll type Bender.	£ 150.		
		All machines to be supplied with holding down bolts.			
		BLACKSMITHS SHOP			
69.	1	2 cwt. Electric pneumatic hammer.	£ 1,000.	3	
70.	1	5 cwt. Electric pneumatic hammer.	£ 1,400.	5	
71.	12	Single Smiths hearths, each 60" x 60" with Blowers.	£ 900.	6	
72.	12	Double Smiths hearths, each 60" x 60" with blowers.	£ 1,800.	12	
73.	20	Anvils, 224 lbs. each.	£ 80.		
74.	5	Sample set of tongs, sets, swages etc.	£ 60.		
75.	1	Overhead crane, 5 tons (see list of Cranes).			
		All Machines to be supplied with holding down bolts.			
		HULL SHOP			
76.	1	One man punch with double tables.	£ 5,000.	10	
77.	1	Mangle.	£ 2,500.	20	
78.	1	Beam bending and punching machine.	£ 2,000.	25	
79.	2	Double ended punch and shears machine.	£ 5,000.	20	
80.	4	Double ended punches.	£ 6,000.	48	
81.	1	80 ft. rolls up 1.1/8".	£ 9,200.	80	
82.	1	30 ft. planing machine.	£ 9,000.	40	
83.	4	Countersinking drills.	£ 3,500.	30	
		Carried forward	£176,610	1489	

Item No.	No.	Description.	Approx. cost F.O.B.	H.P.	Remarks.
		Brought forward	£176,610.	1489	
84.	6	Radial drilling machines, 10 ft. radius.	£ 12,000.	45	
85.	1	Joggling machine.	£ 1,000.		
86.	1	Keel plate and flanging machine.	£ 3,000.		
87.	1	Drilling machine for frames.	£ 1,500.	10	
88.	1	Frame bevelling machine.	£ 3,500.	15	
89.	1	Pravograph burring machine.	£ 1,200.	1	
90.	1	Four headed plano burring machine.	£ 1,500.	2	
91.	1	Rivet making machine.	£ 1,500.	12	
92.	2	Overhead cranes, 10 tons (see list of Cranes).			
93.	1	Small rolls with extending top roller for mast rolling.	£ 5,000.	40	
94.	2	Frame bending rams (hydraulic).	£ 2,000.		
		All Machines to be supplied with holding down bolts.			
		<u>FURNACE</u> - Oil Fired			
95.	1	Combined plate and angle furnace, oil fired, with all necessary nozzles, blowers, tanks, piping and bricks complete -			
		Angle furnace 50' x 3' Plate " 30' x 7'	£ 10,000	10	
96.	100	Cast iron blocks 6' x 4' for frame bending, about 2 tons each.	£ 5,000		
		<u>CARPENTERS SHOP</u>			
97.	1	72" Heavy log band saw; with extended table.	£ 4,000.	75	
98.	1	36" Circular Saw.	£ 300.	15	
99.	1	32" " "	£ 300.	12	
100.	1	30" " "	£ 250.	12	
		Carried forward	£228,760.	1738	

Item No.	No.	Description.	Approx. cost F.O.B.	H.P.	Remarks
		Brought forward	£228,760.	1738	
101.	1	36" Band Saw.	£ 250.	20	
102.	1	30" " "	£ 250.	20	
103.	2	Vertical borers up to 2" x 6".	£ 600.	6	
104.	2	Vertical borers up to 1" x 6".	£ 500.	6	
105.	1	30" Planer and Thicknesser.	£ 600.	8	
106.	1	24" x 9" Planer and Thicknesser.	£ 500.	8	
107.	1	24" Planer.	£ 750.	20	
108.	1	16" Hand feed surface planer.	£ 400.	5	
109.	2	Single spindle moulding machines.	£ 600.	12	
110.	1	Chain and morticing machine.	£ 700.	8	
111.	1	Tenoning machine.	£ 600.	8	
112.	1	Wood turning lathe.	£ 150.	3	
113.	1	Dovetailing machine.	£ 100.	5	
114.	1	Wood trimmer 8".	£ 50.		
115.	1	" " 12".	£ 100.		
116.	1	Straight line edger.	£ 900.	15	
117.	1	Holroyd girder.			
118.	1	Automatic band for saw sharpener.	£ 300.	2	
119.	1	Electric band for brazer.	£ 60.	2	
120.	1	Heavy saw stretcher.	£ 50.	1	
121.	1	Band saw sharpener.	£ 100.	2	
122.	1	Lap grinder for log band saw.	£ 100.		
123.	1	Circular saw sharpener.	£ 180.	2	
		Small gear to be supplied with all Machines.			
		All Machines to be supplied with holding down bolts.			
		MOULDING LOFT - All Machines to be of the latest practice.			
124.	2	32" Band Saws.	£ 360.	12	
		Carried forward	£236,960.	1903	

Item No.	No.	Description.	Approx. cost F.O.B.	H.P.	Remarks.
		Brought forward	£236,950.	1903	
125.	1	21" Plain saw bench, table 39" x 21".	£ 200.	12	
126.	2	Vertical drilling machines 1" holes. Range of spindle 12".	2 70.	12	
127.	2	Vertical drilling machines, 2" holes. Range of spindle 12".	2 150.	12	
		All Machines to be supplied with holding down bolts.			
			£237,390.	1939	
		Allow for hand tools and portable equipment for all shops.	10,620.		
		Total	£248,000.		

Appendix "C"

BERTRAM SHIPYARD

Miscellaneous Plant and Equipment.

	Location	Item	No.	Approx. Cost F.C.B.
1	Shipyard.	"Lister" Trucks and Trailers.	10	£ 3,000
2	Shipyard & Jetty.	Locomotives Diesel Shunting.	4	£30,000
3	Shipyard.	Timber Steaming Tank.	1	£ 1,000
4	"	100 ton Hauling Winch.	1	£ 6,000
5	"	15 ton Hauling Winch.	1	£ 1,500
6	Jetty.	Electric Capstans.	6	£ 3,000
				£44,500

Appendix "D"

SHEKAL SHIPYARD

ESTIMATED CONSTRUCTION COSTS.

	Unit.	Cost Rs./	Total Rs./
1. Jetty, fitting out and deep water berths of reinforced concrete deck and piers.			
(a) Jetty to 1,500 ft. from high water 1,500' x 34' = 51,000 s.ft.	foot super	35	18,00,000
(b) Fitting out wharf 1,000' x 55' = 55,000 s.ft.	"	42	22,00,000
(c) Jetty to deep water wharf 1,500' x 34' = 51,000 s.ft.	"	55	28,00,000
(d) Deep water wharf 1,000' x 92' = 92,000 s.ft.	"	55	50,00,000
			118,00,000
Note:- Above estimated costs may be taken to include road surfacing, rail tracks, footways, etc. Assumed deck loading is 300 lbs. per foot super, heavy shunting locos, and 3 ton mobile cranes.			
2. SHIPYARD.			
(a) Made up ground to workshops floor level assumed 4'0" above high water and 1 in 50 slope to ways.			
4.1 million cub.ft. of filling.	100 c.ft.	4	1,64,000
(b) Concrete foundations, beams under lanching ways and floor slabs.			
850,000 cu.ft. concrete.	"	130	8,50,000
(c) Workshops sheds, steel frame buildings.			
6 million cu.ft. enclosed space	"	17	10,20,000
(d) Shipbuilding berth sheds.			
12 million cu.ft.	"	17	20,40,000
Carried forward			40,74,000

	Unit.	Cost, Rs./	Total Rs./
Brought forward			40,74,000
(e) Prefabricating bay sheds. 4 million cu.ft.	100 cu.ft.	17	6,80,000
(f) Allow for Offices, Stores, Water Supplies, Drainage, yard trade layout, & miscellaneous services.	-	-	5,20,000
Total for Shipyard			52,74,000
3. POWER STATION.			
(a) 3/750 K.W. and 2/350 K.W. diesel alternators, complete with switchgear, cooling towers, and overhead crane.	-	-	12,00,000
(b) Add 25% for freight, customs and erection.			3,00,000
(c) Allow for power house, foundations and erection.	-	-	6,50,000
(d) Allow for distribution and wiring to shops and jetty.	-	-	2,00,000
Total for Power Station			23,50,000

	Unit.	Cost, Rs./	Total Rs./
Brought forward			40,74,000
(e) Prefabricating bay sheds. 4 million cu.ft.	100 cu.ft.	17	6,80,000
(f) Allow for Offices, Stores, Water Supplies, Drainage, yard trade layout, & miscellaneous services.	-	-	5,20,000
Total for Shipyard			52,74,000
3. POWER STATION.			
(a) 3/750 H.P. and 2/350 H.P. diesel alternators, complete with switchgear, cooling towers, and overhead crane.	-	-	12,00,000
(b) Add 25% for freight, customs and erection.			3,00,000
(c) Allow for power house, foundations and erection.	-	-	6,50,000
(d) Allow for distribution and wiring to shops and jetty.	-	-	2,00,000
Total for Power Station			23,50,000

Appendix "E"

BHATKAL SHIPYARD

ESTIMATED COSTS - SUMMARY.

			Rs.,
1.	Jetty and Shipping Berths.		118,00,000
2.	Shipyard foundations and structures.		52,74,000
3.	Power Station and Equipment complete.		25,50,000
4.	Cranes (as per list).	£126,000 f.o.b.	
5.	Workshops Machinery. (as per list).	£248,000 f.o.b.	
6.	Miscellaneous Plant & Equipment (as per list)	£ 45,000 f.o.b.	
	Total	£419,000 f.o.b.	56,00,000
7.	Add 25% to cover freight, insurance, customs duty and erection of Items 4, 5 and 6.		14,00,000
			264,24,000
8.	Add for cost of preliminary site survey and exploration.		1,30,000
9.	Add for contingencies.		9,46,000
	Total	Rs/-	275,00,000

(or approximately £2,000,000)

NOTE:- If the approach jetty is shortened to 1,500 feet, Item 1 will be reduced by Rs./- 58,00,000, and the total cost will be reduced to Rs./- 2,37,00,000 (or approximately £1,750,000).

PROPOSED SHIPYARD PERSONNEL.

Br. = British or European
Ind. = Indian

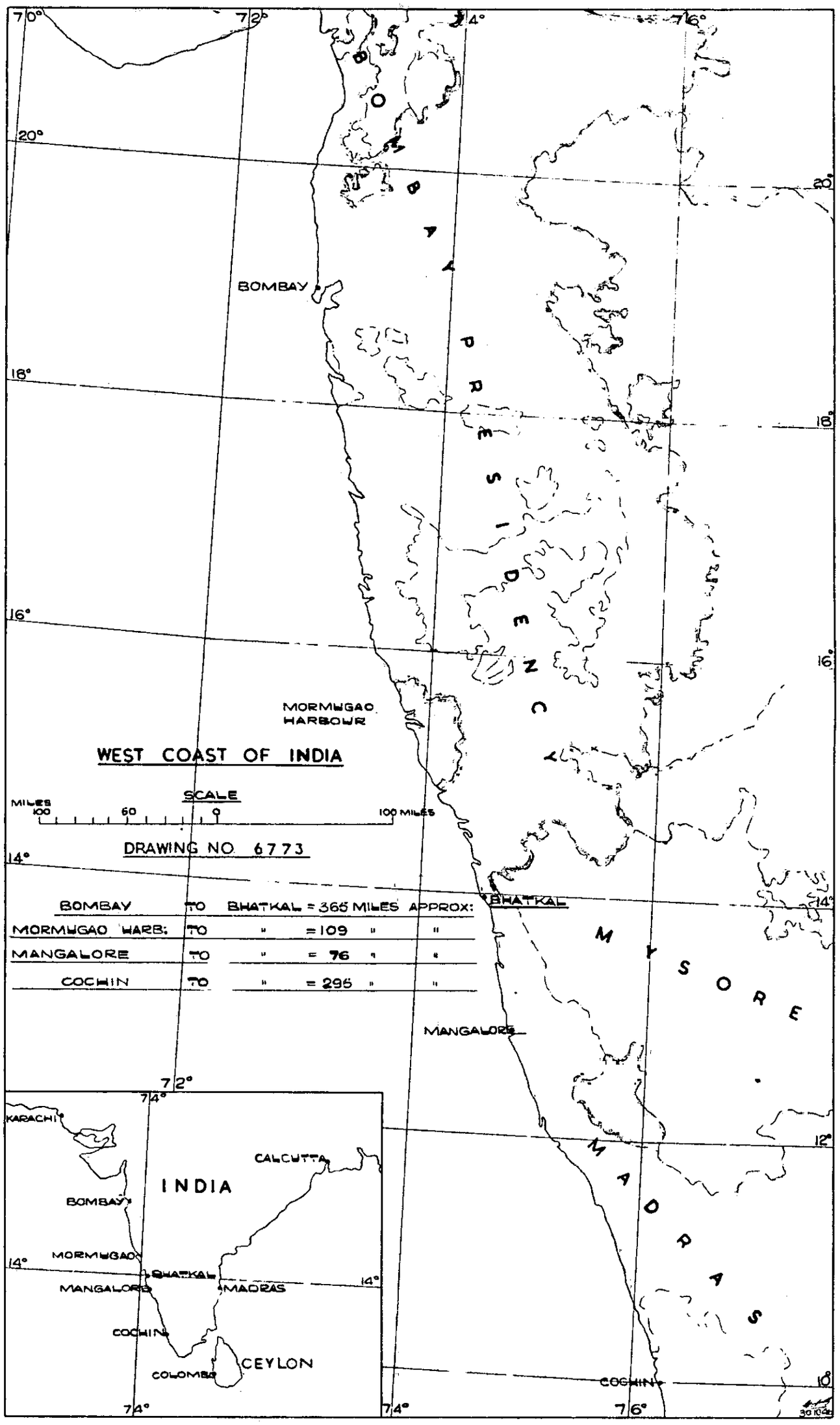
Staff and Tradesmen	Nationality	Number employed	Wage Rate Per Day Rs/	Total Wages Per Day Rs/	Number of Days Per Month	Monthly Rate Rs/	Total Monthly Wages Rs/	
Management								
General Manager	Br.	1					4000	
Assistant do. (T)	Br.	1					1200	
Assistant do. (C)	Br.	1					1200	6400
Drawing Office								
Chief Draughtsman	Br.	1					1000	
Assistant do.	Br.	1					750	
Draughtsmen	Ind.	40				200	8000	9750
Counting House								
Secretary	Ind.	1					600	
" Assistants	Ind.	3				150	450	
Clerks	Ind.	40				150	6000	
Storemen	Ind.	12				150	1800	
Peons	Ind.	20				20	400	
Watchmen	Ind.	24				40	960	
Time Keepers	Ind.	10				150	1500	11710
Shipyard Personnel & Workmen								
Carpenter-Foreman	Br.	1					750	
" Asst. Supervisor	Ind.	3				150	450	
" Workmen	Ind.	300	3	900	30		27000	
" Coolies	Ind.	60	1½	90	30		2700	30900
Joiner-Foreman	Ind.	1					250	
" Asst. Supervisor	Ind.	2				150	300	
" Workmen	Ind.	50	3	150	30		4500	
" Coolies	Ind.	10	1½	15	30		450	5500
Loftsman-Foreman	Br.	1					750	
" Asst. Supervisor	Br.	6				600	3600	
" Assistants	Ind.	12				150	1800	
" Coolies	Ind.	6	1½	9	30		270	6420

APPENDIX F. (II)

Staff and Workmen	Nationality	Number Engaged	Wage Rate Per Day Rs/	Total Wages Per Day Rs/	Number of Days Per Month	Monthly Rate Rs/	Total Monthly Wages Rs/	
Plater-Foreman	Br.	1				150	750	
" Asst. Supervisors	Ind.	6					900	
Workmen - Platers	Ind.	20	4	80	30		2400	
" Platers-Helpers	Ind.	40	2	80	30		2400	
" Caulkers	Ind.	20	4	80	30		2400	
" Drillers	Ind.	20	4	80	30		2400	
Coolies	Ind.	80	1½	120	30		3600	
Riveters (50 Squads)	Ind.	300	4	1200	30		36000	50850
Welder-Foreman	Br.	1				600	750	
" Asst. Supervisors	Br.	1				150	1200	
" " "	Ind.	12					1800	
" Workmen	Ind.	40	4	160	30		4800	
Coolies	Ind.	8	1½	12	30		360	8910
Blacksmith-Foreman	Ind.	1				150	300	
" Asst. Supervisors	Ind.	3					450	
" Workmen	Ind.	30	3	90	30		2700	
Coolies	Ind.	6	1½	9	30		270	3720
Plumber-Foreman	Br.	1				150	750	
" Asst. Supervisors	Ind.	3					450	
" Workmen Plumber & Coppersmith	Ind.	30	4	120	30		3600	
Coolies	Ind.	6	1½	9	30		270	5070
Moulder-Foreman	Ind.	1				150	300	
" Asst. Supervisors	Ind.	3					450	
Workmen	Ind.	10	3	30	30		900	
Coolies	Ind.	2	1½	3	30		90	1740

Staff and Workmen	Nationality	Number Engaged	Wage Rate Per Day Rs/	Total Wages Per Day Rs/	Number of Days Per Month	Monthly Rate Rs/	Total Monthly Wages Rs/	
Sheet-ironworker-Foreman	Ind.	1					300	
" Asst. Supervisors	Ind.	3				150	450	
Workmen	Ind.	20	3	60	30		1800	
Coolies	Ind.	6	1½	9	30		270	2820
Painter-Foreman	Ind.	1					200	
" Asst. Supervisors	Ind.	3				150	450	
Workmen	Ind.	10	3	30	30		900	
Coolies	Ind.	2	1½	3	30		90	1640
Rigger-Foreman	Ind.	1					250	
" Asst. Supervisors	Ind.	6				150	900	
Workmen	Ind.	10	3	30	30		900	
Coolies	Ind.	2	1½	3	30		90	2140
Engineer-Foreman	Br.	1					750	
" Asst. Supervisors	Ind.	6				200	1200	
Workmen	Ind.	50	4	200	30		6000	
Crane Drivers	Ind.	10	3	30	30		900	
Coolies	Ind.	10	1½	15	30		450	9300
Patternmaker-Foreman	Br.	1					750	
" Asst. Supervisors	Ind.	6				200	1200	
Workmen	Ind.	10	4	40	30		1200	
Coolies	Ind.	2	1½	3	30		90	3240

Staff and Workmen	Nationality	Number Engaged	Wage Rate Per Day Rs/	Total Wages PER Day Rs/	Number of Days Per Month	Monthly Rate Rs/	Total Monthly Wages Rs/	
Electrician-Foreman	Ind.	1					500	
" Asst. Supervisors	Ind.	3				150	450	
Workmen	Ind.	5	4	20	30		600	
Coolies	Ind.	2	1½	3	30		90	1640
Power-Engineer - Foreman	Ind.	1					500	
" Supervisor (Yard)	Ind.	3				150	450	
Workmen (Crane)	Ind.	10	4	40	30		1200	
Coolies	Ind.	2	1½	3	30		90	2240
Steel-Sorter - Foreman	Ind.	1					250.	
" Asst. Supervisors	Ind.	6				150	900	
Coolies	Ind.	20	2	40	30		1200	2350
Shipyard Sweepers	Ind.	20	1½	30	30		900	900
Bombay Office								
Clerks	Ind.	10				200	2000	2000
Fitting Out Wharf								
Wharf Master	Br.	1				1000	1000	
Crane Operators	Ind.	10	3	30	30		900	
Railway Operating Staff	Ind.	20	3	60	30		1800	
Stevedores	Ind.	6	3	18	30		540	
Khalassi	Ind.	12	1½	18	30		540	4780
Yard Maintenance Staff								
Asst. Engineer	Ind.	1					250	
Tradesmen (various)	Ind.	4	4	16	30		480	
Coolies	Ind.	20	1½	30	30		900	1630
								1,75,650


70°
72°
74°
76°
20°
18°
16°
14°
12°
10°
BOMBAY
BHATKAL
MANGALORE
MORMUGAO HARBOUR
ARABIAN SEA
MYSORE
MADRAS
WEST COAST OF INDIA
SCALE
MILES 100 60 0 100 MILES
DRAWING NO 6773
BOMBAY TO BHATKAL = 365 MILES APPROX:
MORMUGAO HARB: TO " = 109 " "
MANGALORE TO " = 76 " "
COCHIN TO " = 295 " "
INDIA
KARACHI
CALCUTTA
BOMBAY
MORMUGAO
BHATKAL
MANGALORE
MADRAS
COCHIN
CEYLON
COLOMBO
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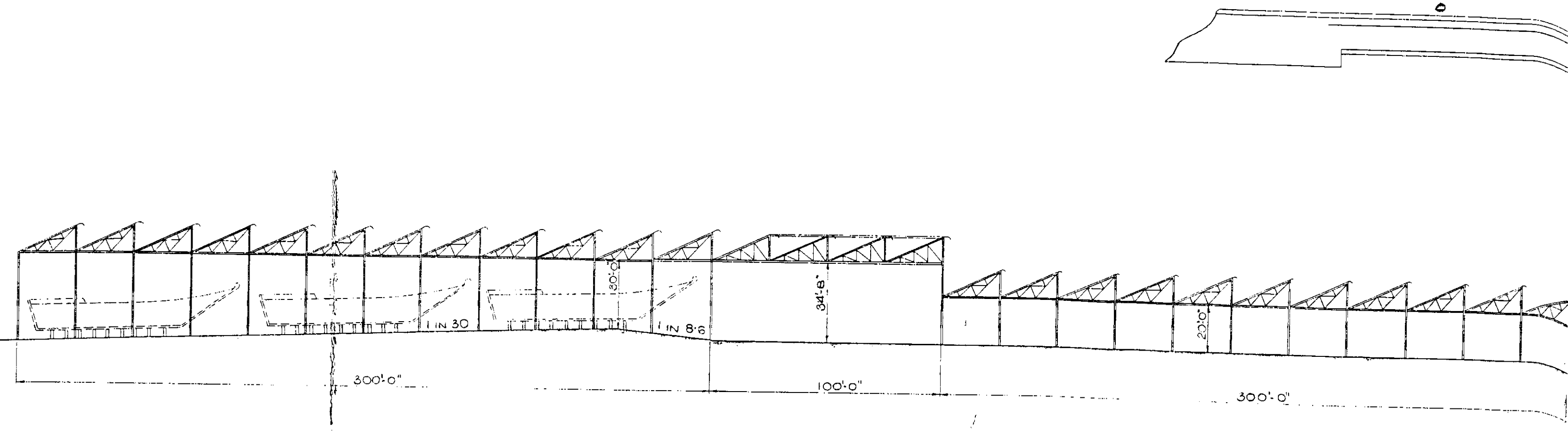
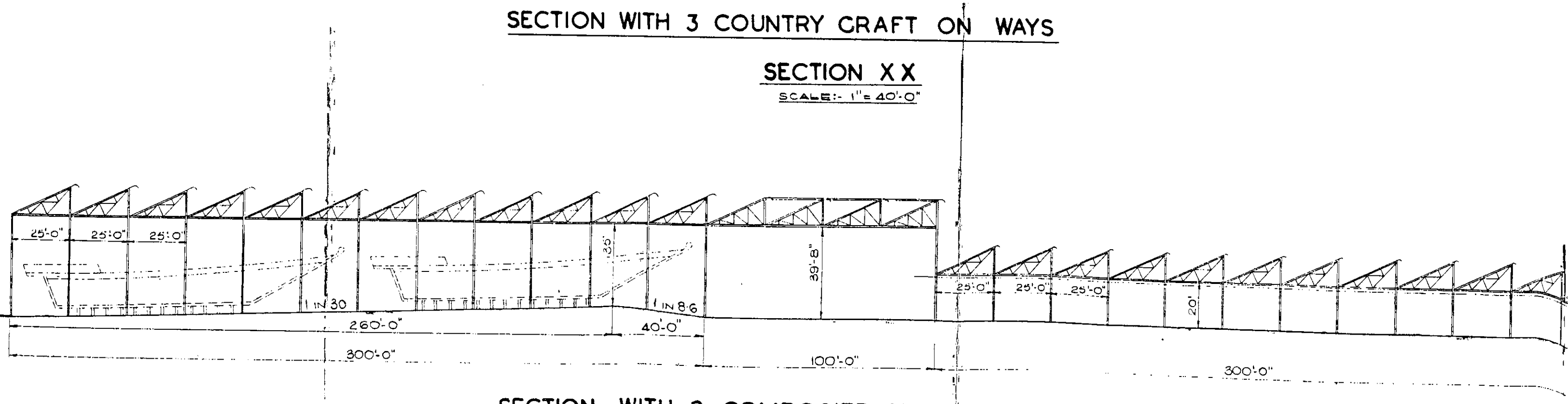


SECTION WITH 3 COUNTRY CRAFT ON WAYS

SECTION X X

SCALE:- 1"= 40'-0"



SECTION WITH 2 COMPOSITE CRAFT ON WAYS

SECTION Y Y

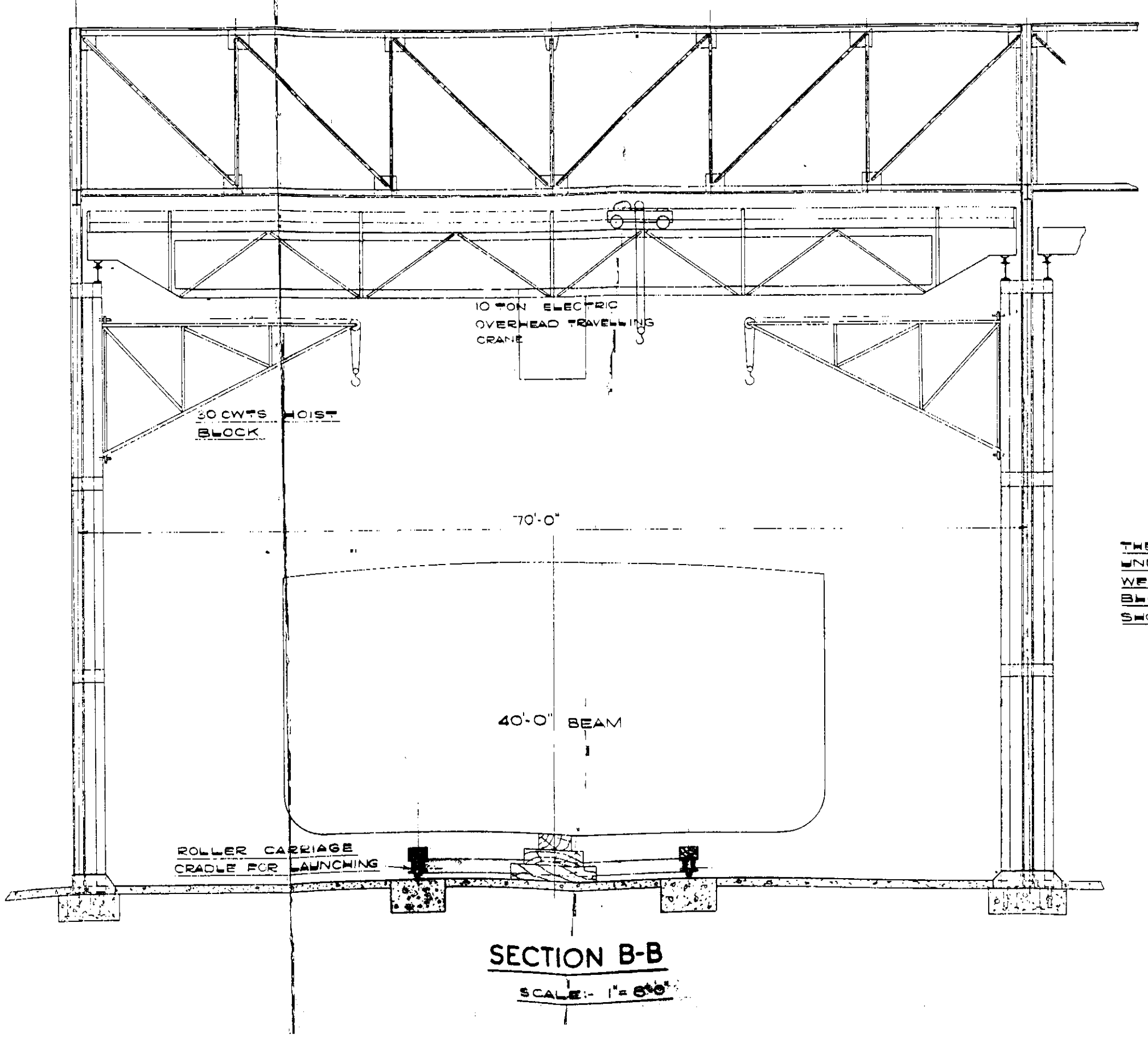
SCALE:- 1"= 40'-0"

300'-0" 100'-0" 300'-0"

SECTION WITH 240' STEEL SHIP ON SLIPWAY

SECTION Z Z

SCALE:- 1"=40'-0"



SECTION B-B

SCALE:- 1"=8'-0"

THE ROLLER CARRIAGES ARE ASSEMBLED UNDER CRAFT ON COMPLETION & THE WEIGHT TRANSFERRED FROM THE BUILDING BLOCKS. IN CROSS SECTION THE BUILDING SHORES HAVE BEEN OMITTED

ROACH JETTY

MAIN OFFICE 50' x 130'

TIME OFFICE 50' x 70'

ENTRANCE

BOAT BUILDING (SAILMAKERS & RIGGERS OVER)

SAW MILL (SAILMAKERS & RIGGERS OVER)

CARPENTERS

JOINERS

STORES (SHIPS & CHANDLERS)

HULL SHOP (MOULDING LOFT OVER)

HULL SHOP

HULL SHOP

WELDING

BLACKSMITHS

MACHINE SHOP

ERECTING

FOUNDRY

STEEL STOCK YARD

TIMBER STOCK YARD & SAW-MILL

STORES

STORES

STORES

POWER STATION

BOUNDARY

160'-0"

300'-0"

60'-0"

240'-0"

60'-0"

1,210'-0"

65'-0"

80'-0"

80'-0"

70'-0"

1,110'-0"

51 COUNTRY CRAFT OF 100 TONS

10 COMPOSITE CRAFT OF 100 TONS

X

Y

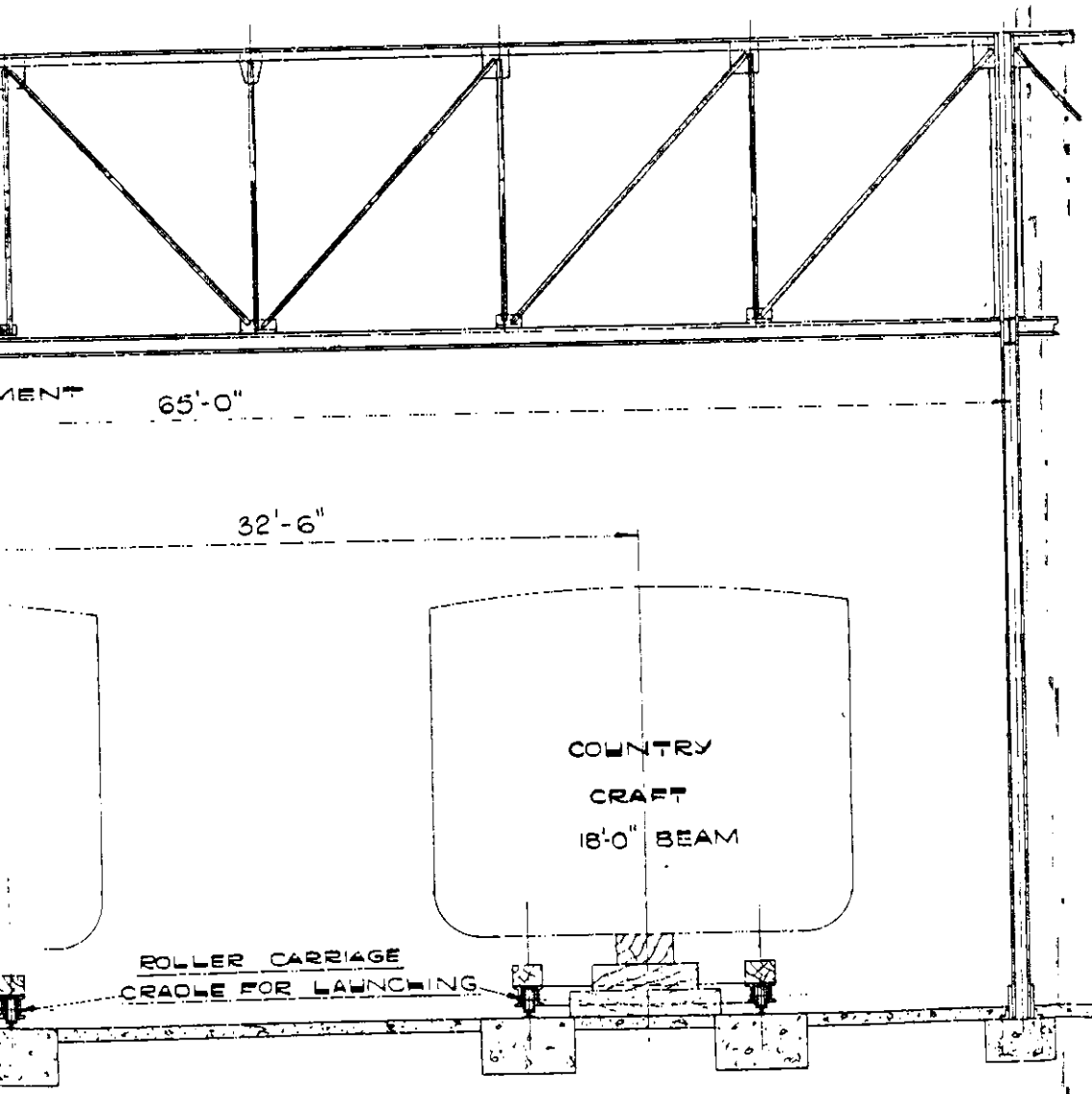
Z

N

1,050'-0"

PLAN OF SHIPYARD

SCALE:- 1" = 100'-0"



SECTION C-C

SCALE:- 1" = 8'-0"

NOTE:-
THE GENERAL LAYOUT & CONSTRUCTION SHOWN ON THIS DRAWING ARE TYPICAL ONLY, AND DETAILS SHOULD BE REGARDED AS PROVISIONAL SUGGESTIONS PENDING A COMPLETE SURVEY OF THE AREA

SIR BRUCE WHITE, WOLFE BARRY & PARTNERS
M.I.C.E., M.I.

BHATKAL SHIPYARD

TITLE OF DRAWING	WORKSHOPS & BUILDING SLIPS
SCALES	1" = 8'-0"; 40'-0"; 100'-0".

SIR BRUCE WHITE WOLFE BARRY & PARTNERS
DRAWING NO: 6775

REMARKS